# Lab 8 - Requirements Analysis

Friday, April 24, 2020 10:48 AM

System functions - fuel control and temperature monitoring

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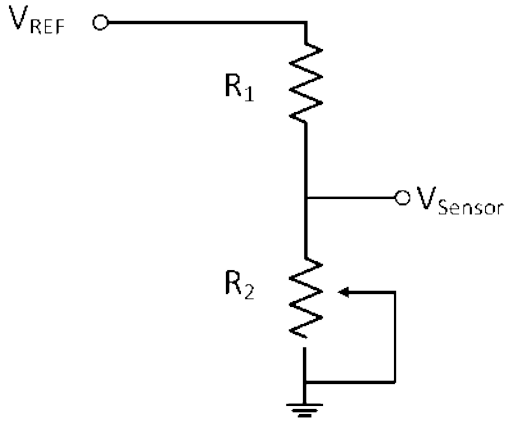
|---|---|
| Components: | MX7 Board |
| | LCD Display |
| | TMP3 - temperature module |
| | 8-LED module |
| | Breadboard Module |

Implementation Requirements:

- Use the breadboard and voltage divider circuit to simulate a pressure transducer on a vehicle "gas pedal" that generates a variable voltage proportional to how much the pedal is pressed.
- The signal is fed to an Analog to Digital Converter (ADC) for processing in the PIC32 microcontroller.
- Determine the range of voltages generated by the circuit which simulates the pressure sensor
- 0 Volts - pedal not being pressed
- Max Voltage - "Pedal to the metal", or the pedal is pressed all the way down.
- Determine voltage levels that will correspond in a linear manner to 7 increments that will be displayed on the 8 LED module.
- Monitor temperature and signal the driver of an overheated condition if the temperature rises above 80°F. The temperature is displayed on the LCD display and the overheated message is flashed on the display, overwriting the temperature.
- An overheated condition does not affect the pedal input to the engine.

Analysis:

We need to determine the range of the signal provided by the circuit that simulated the pedal pressure sensor. The equivalent circuit is shown below.




Using the voltage divider circuit shown, the $V_{sensor}$ voltage is given by the following formula:

$$V_{Sensor} = V_{REF} * \frac{R_2}{(R_1 + R_2)}$$

With the wiring configuration shown, $R_2$ ranges from a maximum value to 0Ω, depending on the wiper position.

Component values:
$V_{REF}$ = 3.2 V
$R_1$ = 2.15 KΩ
$R_2$ = 5.14 KΩ

Using these values, we can calculate the range of input voltages.
$V_{IN\ MIN}$ = 0.0 V
$V_{IN\ MAX}$ = 2.26V

Finally, we consider the resolution of the ADC

$$\frac{3.2\ V}{1024\ Steps} = 0.0031\ \frac{V}{Step}$$

Or, the resolution of our ADC is 3.1 mV